Amendment

(Amendment Under Article 11)

To: Commissioner, Patent Office

1. INTERNATIONAL APPLICATION NO.

PCT/JP03/01579

2. APPLICANT

Name	HONDA GIKEN KOGYO KABUSHIKI KAISHA
Address	1-1, Minami-Aoyama 2-chome, Minato-ku, Tokyo 107-8556 JAPAN
Nationality	JAPAN
Residence	JAPAN

3. ATTORNEY

Name	(8197) Patent Attorney YOSHIDA Yutaka
Address	816, Ikebukuro White House Building, 20-2, Higashi Ikebukuro 1-chome, Toshima-ku, Tokyo 170-0013 JAPAN

4. SUBJECT TO BE AMENDED

Description

Claims

5. DESCRIPTION OF AMENDMENT

As stated in the annexed.

(1) Amended in Specification P.2, L.6 to 7, "when an abnormality is self-diagnosed ("determined" in Japanese) by the self-diagnosis means," to --- when an abnormality is self-diagnosed by the self-diagnosis means, ---. (As underlined)

(2) Amended in Specification P.2, L.7 to 11, "abnormality degree discriminating means for inputting the output of the abnormality information outputting means and for discriminating degree of abnormality based on the abnormality information; and stable state driving means for driving the robot into a stable state in response to the discriminated degree of abnormality" to --- abnormality degree discriminating means for inputting the output of the abnormality information outputting means and for discriminating degree of abnormality in accordance with ranks defined in advance including stopping of locomotion of the robot based on the abnormality information; and stable state controlling means for controlling the robot into a stable state in response to the discriminated degree of abnormality based on a predetermined action plan chart ---. (As underlined)

(3) Amended in Specification P.2, L.23 to 27, "Further, this invention provides, as recited in claim 2 mentioned below, the system in which the stable state driving means drives the robot into a stable state in response to the discriminated degree of abnormality based on a predetermined action plan chart. Thus, since it is configured such that the robot is driven into a stable state in response to the discriminated" to --- Further, since it is configured such that the robot is driven into a stable state in response to the discriminated ---. (As underlined)

(4) Amended in Claim 1, "b. abnormality information outputting means for outputting, when an abnormality is self-diagnosed ("determined" in Japanese) by the self-diagnosis means, information of the abnormality; c. abnormality degree discriminating means for inputting the output of the abnormality information outputting means and for discriminating degree of abnormality based on the abnormality information; and d. stable state driving means for driving the robot into a stable state in response to the discriminated degree of abnormality" to --- b.

abnormality information outputting means for outputting, when an abnormality is self-diagnosed by the self-diagnosis means, information of the abnormality; c. abnormality degree discriminating means for inputting the output of the abnormality information outputting means and for discriminating degree of abnormality in accordance with ranks defined in advance including stopping of locomotion of the robot based on the abnormality information; and d. stable state controlling means for controlling the robot into a stable state in response to the discriminated degree of abnormality based on a predetermined action plan chart ---. (As underlined)

(5) Claim 2 is deleted.

(6) Amended in Claim 3, "The system according to claim 1 or 2, further including:" to --- The system according to claim 1, further including: ---. (As underlined)

(Note: the numbers of page and line in Specification are expressed in accordance with the English text.)

6. PAPERS ATTACHED HERETO

Specification	A replaced paper of P. 2	1
Claim	A replaced paper of P. 21	1

means for outputting, when an abnormality is self-diagnosed by the self-diagnosis means, information of the abnormality; abnormality degree discriminating means for inputting the output of the abnormality information outputting means and for discriminating degree of abnormality in accordance with ranks defined in advance including stopping of locomotion of the robot based on the abnormality information; and stable state controlling means for controlling the robot into a stable state in response to the discriminated degree of abnormality based on a predetermined action plan chart. Thus, since it is configured such that it is self-diagnosed whether the quantity of state is an abnormal value, or whether at least one of the internal sensor, etc., is abnormal and when an abnormality is self-diagnosed, abnormality information is outputted, then the degree of abnormality is discriminated based on the outputted abnormality information and the robot is driven into a stable state in response to the discriminated degree of abnormality, it becomes possible to effectively utilize the abnormality detection result. In addition, since the robot is driven into a stable state in response to the discriminated degree of abnormality, it becomes possible to render the driving appropriate. It should be noted that, in this specification, "abnormality" means whole cases other than normal, which are non-normal conditions due to any events including deterioration, failure and damages.

Further, since it is configured such that the robot is driven into a stable state in response to the discriminated degree of abnormality based on a predetermined action plan chart, in addition to the effects and advantages mentioned above, it becomes possible to render driving into a stable state more appropriately.

Further, this invention provides, as recited in claim 3 mentioned below, the system further including: abnormality degree storing means for storing the discriminated degree of abnormality in an internal memory provided in the control unit and in an external memory provided outside the robot. Thus, since it is configured such that the discriminated degree of abnormality is stored in an internal

memory and in an external memory, in addition to the effects and advantages, it becomes possible to improve the reliability of abnormality detection of the mobile robot.

Further, this invention provides, as recited in claim 4 mentioned below, the system in which the abnormality degree storing means stores the output of the abnormality degree discriminating means and a parameter indicative of the quantity of state of the robot, in an internal memory provided in the control unit and in an external memory provided outside the robot. Thus, since it is configured such that the degree of abnormality and a parameter indicative of the quantity of state of the robot

CLAIMS

1. (Amended) A system for detecting abnormality of a mobile robot having at least a drive motor, an internal sensor that senses a quantity of state of the internal of the robot and a control unit constituted by an onboard microcomputer that operates the drive motor based on the quantity of state obtained from an output of the internal sensor to move, the control unit comprising:

a. self-diagnosis means for self-diagnosing whether the quantity of state is an abnormal value, or whether at least one of onboard equipments mounted on the robot including at least the drive motor and the internal sensor is abnormal;

b. abnormality information outputting means for outputting, when an abnormality is self-diagnosed by the self-diagnosis means, information of the abnormality;

c. abnormality degree discriminating means for inputting the output of the abnormality information outputting means and for discriminating degree of abnormality in accordance with ranks defined in advance including stopping of locomotion of the robot based on the abnormality information; and

d. stable state controlling means for controlling the robot into a stable state in response to the discriminated degree of abnormality based on a predetermined action plan chart.

2. (Deleted)

3. (Amended) The system according to claim 1, further including:

e. abnormality degree storing means for storing the discriminated degree of abnormality in an internal memory provided in the control unit and in an external memory provided outside the robot.

4. The system according to claim 3, wherein the abnormality degree storing means stores the output of the abnormality degree discriminating means and a parameter indicative of the quantity of state of the robot, in an internal memory provided in the control unit and in an external memory provided outside the robot.

5. The system according to any of claims 1 to 4, wherein the control unit includes:

f. dynamic model behavior correcting means for inputting at least a desired manipulated variable, and based on a dynamic model which outputs a desired behavior of the robot, that is a plant, such that the desired manipulated variable is satisfied, correcting the behavior of the dynamic model, by additionally inputting a correction amount of the desired manipulated variable determined in response to an error in the quantities of state of the dynamic model and the robot to at least the dynamic model; and

g. control means for controlling operation of the drive motor so as to follow the behavior of the dynamic model;

and the self-diagnosis means self-diagnoses that the quantity of state is an abnormal value when the error in the quantities of state of the dynamic model and the robot is not within a predetermined value.

6. The system according to any of claims 1 to 5, wherein the robot has a body and a plurality of leg linkages each swingably connected to the body through a joint and each connected with a foot at its distal end through a joint, the internal sensor includes an inclination sensor that generates an output indicative of an inclination of the body of the robot relative to a vertical axis, and the self-diagnosis means self-diagnoses that the inclination sensor is abnormal when the output of the

inclination sensor is not within a predetermined range.

7. The system according to any of claims 1 to 6, wherein the robot has a body and a plurality of leg linkages each swingably connected to the body through a joint and each connected with a foot at its distal end through a joint; the internal sensor includes an angle detector that generates an output indicative of at least one of an angle, angular velocity and angular acceleration of the joints, and the self-diagnosis means self-diagnoses that the angle detector is abnormal when the output of the angle detector is not within a predetermined range.

8. The system according to any of claims 1 to 7, wherein the onboard equipments include an external sensor that generates an output indicative of taken images.

9. The system according to any of claims 1 to 8, wherein the onboard equipments include a floor reaction force detector that detects a floor reaction force acting on the robot, and the self-diagnosis means self-diagnoses that the floor reaction force detector is abnormal when the output of the floor reaction force detector is not within a predetermined range.

10. The system according to any of claims 1 to 9, wherein the onboard equipments include sensors that detect a current supplied to the drive motor and a temperature of the drive motor, and the self-diagnosis means self-diagnoses that the drive motor is abnormal when at least one of the detected current and temperature is

not within a corresponding one of predetermined ranges set respectively with respect to the current and temperature.

11. The system according to any of claims 1 to 10, wherein the onboard equipments include a battery that supplies a current to the control unit and the drive motor and a voltage sensor that generates an output indicative of a voltage of the battery, and the self-diagnosis means self-diagnoses that the battery is abnormal when the output of the voltage sensor is smaller than a predetermined value.

12. The system according to any of claims 1 to 11, wherein the onboard equipments include a voice recognition system that enables voice communication with an operator.

13. The system according to any of claims 1 to 12, further including:

h. an operator's operation control unit provided outside the robot and comprising a microcomputer that includes the external memory; and

i. communication means connecting the control unit and the operator's operation control unit for establishing communication therebetween;

and the self-diagnosis means self-diagnoses whether the communication means is abnormal.

控

手 続 補 正 書

（法第１１条の規定による補正）

特許庁長官　殿

１．国際出願の表示　　ＰＣＴ／ＪＰ０３／０１５７９

２．出願人

名　称　　本田技研工業株式会社
ＨＯＮＤＡ　ＧＩＫＥＮ　ＫＯＧＹＯ　ＫＡＢＵＳＨＩＫＩ　ＫＡＩＳＨＡ

あて名　　〒107-8556　日本国東京都港区南青山二丁目１番１号
１－１，　Ｍｉｎａｍｉ－Ａｏｙａｍａ　２－ｃｈｏｍｅ，Ｍｉｎａｔｏ－ｋｕ，　Ｔｏｋｙｏ　１０７－８５５６
ＪＡＰＡＮ

国　籍　　日本国　Ｊａｐａｎ

住　所　　日本国　Ｊａｐａｎ

３．代理人

氏　名　　(8197) 弁理士　吉　田　　豊　　吉田豊弁理士印
ＹＯＳＨＩＤＡ　Ｙｕｔａｋａ

あて名　　〒170-0013　日本国東京都豊島区東池袋１丁目２０番２号
池袋ホワイトハウスビル８１６号
８１６，　Ｉｋｅｂｕｋｕｒｏ　Ｗｈｉｔｅ　Ｈｏｕｓｅ　Ｂｕｉｌｄｉｎｇ，　２０－２，　Ｈｉｇａｓｈｉ　Ｉｋｅｂｕｋｕｒｏ　１－ｃｈｏｍｅ，Ｔｏｓｈｉｍａ－ｋｕ，　Ｔｏｋｙｏ　１７０－００１３
ＪＡＰＡＮ

４．補正の対象　　明細書

請求の範囲

５．補正の内容　　別紙の通り

(1)　明細書第２頁第１行の「る自己診断手段、前記自己診断手段によって異常と判定されたとき、その異常情」を『る自己診断手段、前記自己診断手段によって異常と自己診断されたとき、その異常情』と補正する（補正箇所に下線を付す）。

(2)　明細書第２頁第３行から第４行の「常情報に基づいて異常の不具合度を判定する不具合度判定手段、および前記判定された不具合度に応じ、前記ロボットを安定な状態に移行させる安定状態移行手された不具合度に応じ、前記ロボットを安定な状態に移行させる安定状態移行手」を『常情報に基づき、予め設定された、前記ロボットの停止を含む複数のランクに従って異常の不具合度を判定する不具合度判定手段、および前記判定された不具合度に応じ、所定の行動計画表に基づいて前記ロボットが安定な状態に移行するように制御する安定状態制御手』と補正する（補正箇所に下線を付す）。

(3)　明細書第２頁第１４行から第１６行の「また、この発明は、後述する請求の範囲第２項に記載する如く、前記安定状態移行手段は、前記判定された不具合度に応じ、所定の行動計画表に基づいて前記ロボットを安定な状態に移行するように制御する如く構成した。このように、判」を『また、判』と補正する（補正箇所に下線を付す）。

(4)　請求の範囲の第１項の「ｂ．前記自己診断手段によって異常と判定されたとき、その異常情報を出力する異常情報出力手段、ｃ．前記異常情報出力手段の出力を入力して前記異常情報に基づいて異常の不具合度を判定する不具合度判定手段、およびｄ．前記判定された不具合度に応じ、前記ロボットを安定な状態に移行させる安定状態移行手段、」を『ｂ．前記自己診断手段によって異常と自己診断されたとき、その異常情報を出力する異常情報出力手段、ｃ．前記異常情報出力手段の出力を入力して前記異常情報に基づき、予め設定された、前記ロボットの停止を含む複数のランクに従って異常の不具合度を判定する不具合度判定手段、およびｄ．前記判定された不具合度に応じ、所定の行動計画表に基づいて前記ロ

ボットが安定な状態に移行するように制御する安定状態移行制御手段、』と補正する（補正箇所に下線を付す）。

(5)　請求の範囲の第２項を削除する。

(6)　請求の範囲の第３項の「請求の範囲第１項または第２項記載の移動ロボットの異常検知装置。」を『請求の範囲第１項記載の移動ロボットの異常検知装置。』と補正する（補正箇所に下線を付す）。

６．添付書類の目録

明細書	第２頁の新たな用紙	１通
請求の範囲	第２１頁の新たな用紙	１通

る自己診断手段、前記自己診断手段によって異常と自己診断されたとき、その異常情報を出力する異常情報出力手段、前記異常情報出力手段の出力を入力して前記異常情報に基づき、予め設定された、前記ロボットの停止を含む複数のランクに従って異常の不具合度を判定する不具合度判定手段、および前記判定された不具合度に応じ、所定の行動計画表に基づいて前記ロボットが安定な状態に移行するように制御する安定状態制御手段を備える如く構成した。このように、状態量が異常な値か否かあるいは内界センサなどの少なくともいずれかが異常か否か自己診断し、異常と判定されたとき、その異常情報を出力し、それに基づいて異常の不具合度を判定すると共に、判定された不具合度に応じ、ロボットを安定な状態に移行させるように構成したので、移動ロボットの異常検知結果を効果的に活用することができる。また、判定された不具合度に応じて安定な状態に移行させるように構成したので、その移行も適切なものとすることができる。尚、この明細書において「異常」とは正常ではない全ての場合を意味し、劣化、故障、損傷などあらゆる事象によって正常ではないことを意味する。

また、判定された不具合度に応じ、所定の行動計画表に基づいて安定な状態に移行するように制御する如く構成したので、前記した効果に加え、安定状態への移行も一層適切なものとすることができる。

また、この発明は、後述する請求の範囲第３項に記載する如く、さらに、前記判定された不具合度を、前記制御ユニットに設けられた内部メモリに格納すると共に、前記ロボットの外部に設けられた外部メモリに格納する不具合度格納手段を備える如く構成した。このように、判定された不具合度を内部メモリに格納すると共に、外部メモリに格納するようにしたので、前記した効果に加え、移動ロボットの異常検知の信頼性を向上させることができる。

また、この発明は、後述する請求の範囲第４項に記載する如く、前記不具合度格納手段は、前記不具合度判定手段の出力と前記ロボットの状態量を示すパラメータを、前記内部メモリに格納すると共に、前記外部メモリに格納する如く構成した。このように、不具合度とロボットの状態量を示すパラメータを内部メモリ

請求の範囲

1．（補正後）駆動モータと、内部の状態量を測定する内界センサとを少なくとも備え、搭載されたマイクロコンピュータからなる制御ユニットにおいて少なくとも前記内界センサの出力から得た状態量に基づいて前記駆動モータを作動させて移動する移動ロボットの異常を検知する異常検知装置において、前記制御ユニットが、

a．前記状態量が異常な値か否か、あるいは前記内界センサおよび駆動モータを少なくとも含む前記ロボットの搭載機器の少なくともいずれかが異常か否か自己診断する自己診断手段、

b．前記自己診断手段によって異常と自己診断されたとき、その異常情報を出力する異常情報出力手段、

c．前記異常情報出力手段の出力を入力して前記異常情報に基づき、予め設定された、前記ロボットの停止を含む複数のランクに従って異常の不具合度を判定する不具合度判定手段、

および

d．前記判定された不具合度に応じ、所定の行動計画表に基づいて前記ロボットが安定な状態に移行するように制御する安定状態移行制御手段、

を備えることを特徴とする移動ロボットの異常検知装置。

2．（削除）

3．（補正後）さらに、

e．前記判定された不具合度を、前記制御ユニットに設けられた内部メモリに格納すると共に、前記ロボットの外部に設けられた外部メモリに格納する不具合度格納手段、

を備えたことを特徴とする請求の範囲第1項記載の移動ロボットの異常検知装置。

4．前記不具合度格納手段は、前記不具合度判定手段の出力と前記ロボットの状